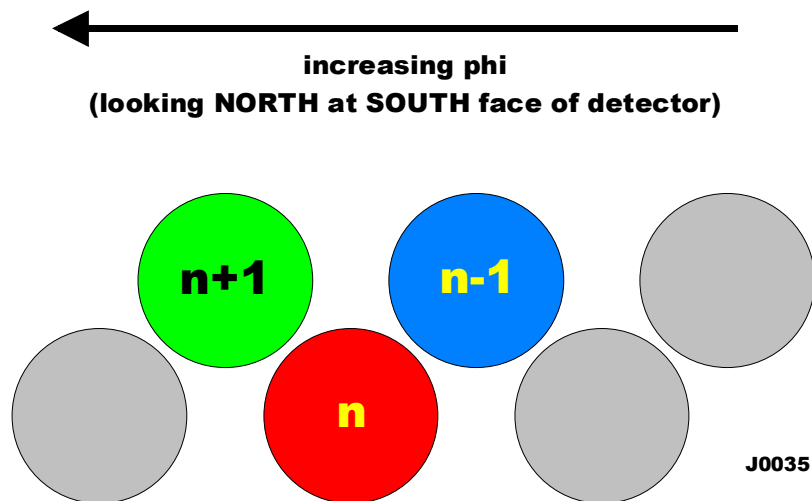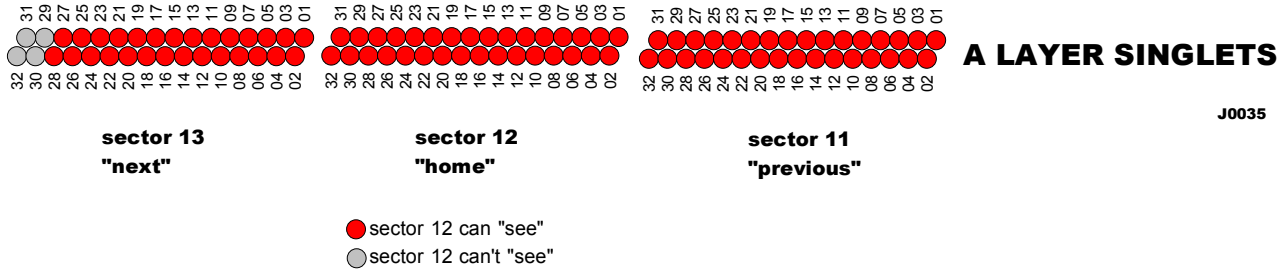**Jamieson T. Olsen**
Engineering Note

Date: 16 July 2001

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Project: DFEA Daughterboard

Doc. No: 2001-07-16a

Subject: DFEA Doublet Generation

Fred Borcherding has described in the CTT Technical Design Report how CFT Axial Doublets are formed using two interleaved CFT fiber layers as follows:

doublet[k] = [NOT singlet(n-1) AND singlet(n)] OR singlet(n+1)

Thus each doublet equation consists of three singlet terms. Due to way that singlets are shared between sectors, there is a single singlet deficiency on the "next edge" of even sectors. This is demonstrated by considering the A layer singlet sharing below:

A LAYER SINGLETS

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sector 13
"next"

sector 12
"home"

sector 11
"previous"

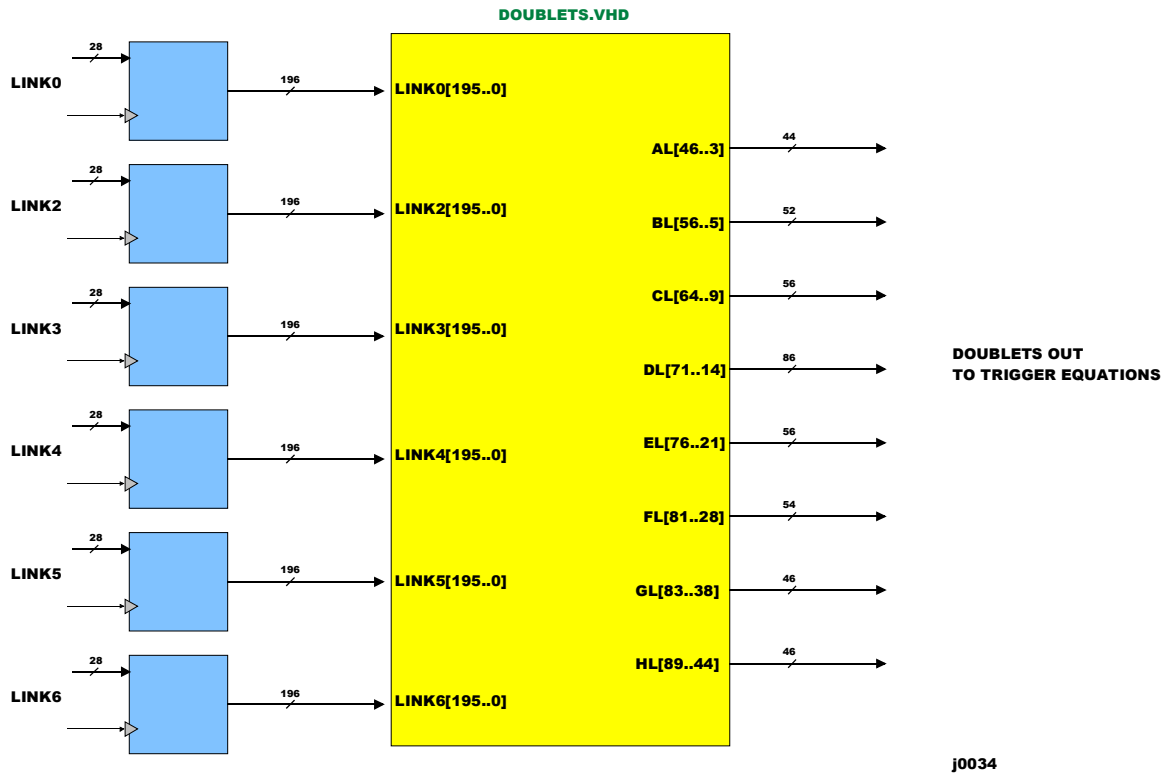● sector 12 can "see"
○ sector 12 can't "see"

The A-Layer doublet equations for sector 12 are as follows:

```
doublet(12, A,  3) = [ not singlet(11, A,  5) and singlet(11, A, 6) ]  or singlet(11, A, 7)
doublet(12, A,  4) = [ not singlet(11, A,  7) and singlet(11, A, 8) ]  or singlet(11, A, 9)
doublet(12, A,  5) = [ not singlet(11, A,  9) and singlet(11, A, 10) ] or singlet(11, A, 11)
doublet(12, A,  6) = [ not singlet(11, A, 11) and singlet(11, A, 12) ] or singlet(11, A, 13)
doublet(12, A,  7) = [ not singlet(11, A, 13) and singlet(11, A, 14) ] or singlet(11, A, 15)
doublet(12, A,  8) = [ not singlet(11, A, 15) and singlet(11, A, 16) ] or singlet(11, A, 17)
doublet(12, A,  9) = [ not singlet(11, A, 17) and singlet(11, A, 18) ] or singlet(11, A, 19)
doublet(12, A, 10) = [ not singlet(11, A, 19) and singlet(11, A, 20) ] or singlet(11, A, 21)
doublet(12, A, 11) = [ not singlet(11, A, 21) and singlet(11, A, 22) ] or singlet(11, A, 23)
doublet(12, A, 12) = [ not singlet(11, A, 23) and singlet(11, A, 24) ] or singlet(11, A, 25)
doublet(12, A, 13) = [ not singlet(11, A, 25) and singlet(11, A, 26) ] or singlet(11, A, 27)
doublet(12, A, 14) = [ not singlet(11, A, 27) and singlet(11, A, 28) ] or singlet(11, A, 29)
doublet(12, A, 15) = [ not singlet(11, A, 29) and singlet(11, A, 30) ] or singlet(11, A, 31)
doublet(12, A, 16) = [ not singlet(11, A, 31) and singlet(11, A, 32) ] or singlet(11, A,  1)
doublet(12, A, 17) = [ not singlet(12, A,  1) and singlet(12, A,  2) ] or singlet(12, A,  3)
doublet(12, A, 18) = [ not singlet(12, A,  3) and singlet(12, A,  4) ] or singlet(12, A,  5)
doublet(12, A, 19) = [ not singlet(12, A,  5) and singlet(12, A,  6) ] or singlet(12, A,  7)
doublet(12, A, 20) = [ not singlet(12, A,  7) and singlet(12, A,  8) ] or singlet(12, A,  9)
doublet(12, A, 21) = [ not singlet(12, A,  9) and singlet(12, A, 10) ] or singlet(12, A, 11)
doublet(12, A, 22) = [ not singlet(12, A, 11) and singlet(12, A, 12) ] or singlet(12, A, 13)
doublet(12, A, 23) = [ not singlet(12, A, 13) and singlet(12, A, 14) ] or singlet(12, A, 15)
doublet(12, A, 24) = [ not singlet(12, A, 15) and singlet(12, A, 16) ] or singlet(12, A, 17)
doublet(12, A, 25) = [ not singlet(12, A, 17) and singlet(12, A, 18) ] or singlet(12, A, 19)
doublet(12, A, 26) = [ not singlet(12, A, 19) and singlet(12, A, 20) ] or singlet(12, A, 21)
doublet(12, A, 27) = [ not singlet(12, A, 21) and singlet(12, A, 22) ] or singlet(12, A, 23)
doublet(12, A, 28) = [ not singlet(12, A, 23) and singlet(12, A, 24) ] or singlet(12, A, 25)
doublet(12, A, 29) = [ not singlet(12, A, 25) and singlet(12, A, 26) ] or singlet(12, A, 27)
doublet(12, A, 30) = [ not singlet(12, A, 27) and singlet(12, A, 28) ] or singlet(12, A, 29)
doublet(12, A, 31) = [ not singlet(12, A, 29) and singlet(12, A, 30) ] or singlet(12, A, 31)
doublet(12, A, 32) = [ not singlet(12, A, 31) and singlet(11, A, 32) ] or singlet(13, A,  1)
doublet(12, A, 33) = [ not singlet(13, A,  1) and singlet(13, A,  2) ] or singlet(13, A,  3)
doublet(12, A, 34) = [ not singlet(13, A,  3) and singlet(13, A,  4) ] or singlet(13, A,  5)
doublet(12, A, 35) = [ not singlet(13, A,  5) and singlet(13, A,  6) ] or singlet(13, A,  7)
doublet(12, A, 36) = [ not singlet(13, A,  7) and singlet(13, A,  8) ] or singlet(13, A,  9)
doublet(12, A, 37) = [ not singlet(13, A,  9) and singlet(13, A, 10) ] or singlet(13, A, 11)
doublet(12, A, 38) = [ not singlet(13, A, 11) and singlet(13, A, 12) ] or singlet(13, A, 13)
doublet(12, A, 39) = [ not singlet(13, A, 13) and singlet(13, A, 14) ] or singlet(13, A, 15)
doublet(12, A, 40) = [ not singlet(13, A, 15) and singlet(13, A, 16) ] or singlet(13, A, 17)
doublet(12, A, 41) = [ not singlet(13, A, 17) and singlet(13, A, 18) ] or singlet(13, A, 19)
doublet(12, A, 42) = [ not singlet(13, A, 19) and singlet(13, A, 20) ] or singlet(13, A, 21)
doublet(12, A, 43) = [ not singlet(13, A, 21) and singlet(13, A, 22) ] or singlet(13, A, 23)
doublet(12, A, 44) = [ not singlet(13, A, 23) and singlet(13, A, 24) ] or singlet(13, A, 25)
doublet(12, A, 45) = [ not singlet(13, A, 25) and singlet(13, A, 26) ] or singlet(13, A, 27)
doublet(12, A, 46) = [ not singlet(13, A, 27) and singlet(13, A, 28) ] or singlet(13, A, 29)
```

The problem is the last doublet equation – home sector 12 cannot "see" `singlet(13, A, 29)`. The approach taken here is to leave that term out of the equation, thus changing the final doublet equation to:

```
doublet(12, A, 46) = [ not singlet(13, A, 27) and singlet(13, A, 28) ]
```

*Keep in mind that that this asymmetry will only affect the most significant doublet equation in each layer for EVEN numbered home sectors. For more information on how singlets are assigned to links and how links are shared, check out my engineering note **1999-01-05A***

DOUBLETS.VHD

LINK0 —28→ [ ] —196→ LINK0[195..0]

LINK2 —28→ [ ] —196→ LINK2[195..0]

LINK3 —28→ [ ] —196→ LINK3[195..0]

LINK4 —28→ [ ] —196→ LINK4[195..0]

LINK5 —28→ [ ] —196→ LINK5[195..0]

LINK6 —28→ [ ] —196→ LINK6[195..0]

AL[46..3] —44→

BL[56..5] —52→

CL[64..9] —56→

DL[71..14] —86→

EL[76..21] —56→

FL[81..28] —54→

GL[83..38] —46→

HL[89..44] —46→

DOUBLETS OUT TO TRIGGER EQUATIONS

j0034

The picture below shows the home sector and the neighbouring sectors. In order to find CFT tracks down to 1.5GeV, the track finder logic needs to see all of the yellow doublets in the home sector, plus all of the green doublets in the neighbouring sectors.

NEXT SECTOR   HOME SECTOR   PREV SECTOR

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